**Chapter 5 Evolution, Biodiversity, and Population Ecology**

**Striking gold in Costa Rica**

* Golden toads were discovered in 1964, in Monteverde, Chile
* The mountainous cloud forest has a perfect climate for amphibians
* Unfortunately, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Due to global warming’s drying effect on the forest

**Evolution: the source of Earth’s biodiversity**

* Biological evolution =

-May be random or directed by natural selection

* Natural Selection =

**Understanding evolution is vital**

* It alters the genetic makeup of a population
* It is important for understanding antibiotic and pesticide resistance, agricultural issues, production, medicines, etc.

**Genetic variation**

* Adaptive Trait (Adaptation) =
* Mutations = accidental changes in DNA that may be passed on to the next generation

-Non-lethal mutations provide the genetic variation on which natural selection acts

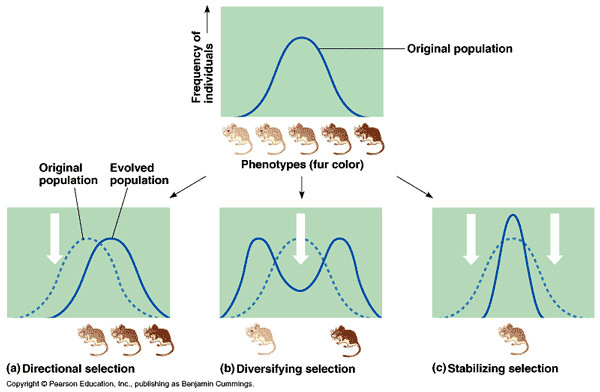
* Sexual reproduction also leads to variation

**Natural selection acts on genetic variation**

Directional selection =

Stabilizing selection =

Disruptive selection =



***If the environment changes, a trait may no longer be adaptive***

**Artificial selection**

Artificial Selection =

For example, artificial selection has led to the great variety of dog breeds

**Evolution generates biodiversity**

Biological Diversity =

* The diversity of species
* Their genes
* Their populations
* Their communities

Species =

Population =

**Speciation produces new types of organisms**

* The process of generating new species
  + A single species can generate multiple species
* Allopatric speciation =
  + Can be separated by glaciers, rivers, mountains
  + The main mode of species creation

**Another type of speciation**

Sympatric speciation =

* Feed in different areas, mate in different seasons
* Hybridization between two species
* Mutations

**Extinction**

* Species generally evolve from simple to complex and small to big, but the opposite can occur, and some even disappear
* Extinction =
  + Speciation and extinction affect species numbers

**Extinction is a natural process**

Extinction is irreversible: once a species is lost, it is lost forever

**Some species are more vulnerable to extinction**

* Extinction occurs when the environment changes too rapidly for natural selection to keep up
* Endemic species =
  + Very susceptible to extinction
  + These species usually have small populations
* Many other factors also cause extinction
  + Severe weather
  + New species
  + Specialized species

**Earth has had several mass extinctions**

* Background extinction rate *=*
* Mass extinction events =
* Humans are causing the sixth mass extinction event

**Ecology is studied at several levels**

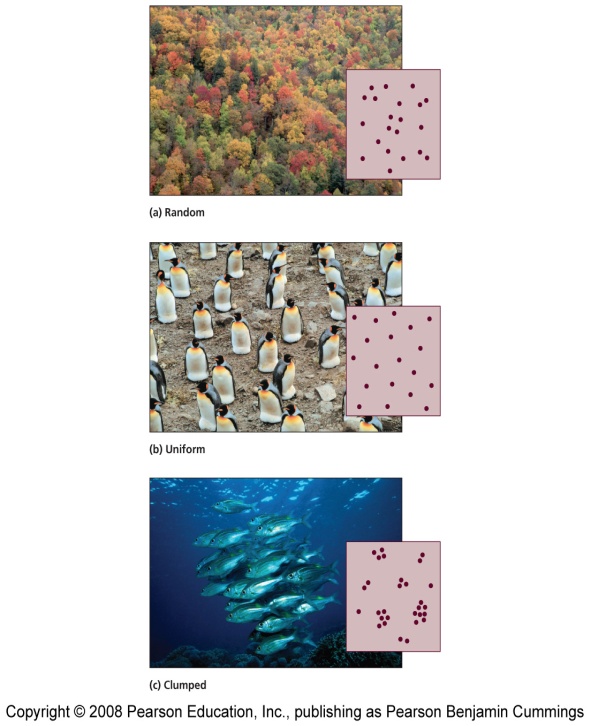
Ecology and evolution are tightly intertwined

* Biosphere =
* Ecosystem = ­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and forces they interact with
* Community = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that live in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ area

**Organismal ecology: habitat**

* Habitat =
  + Includes living and nonliving elements
  + Scale-dependent: from square meters to miles
* Habitat use = each organism thrives in certain habitats, but not in others
* Habitat selection = the process by which organisms actively select habitats in which to live
  + Availability and quality of habitat are crucial to an organism’s well-being
  + \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ conflict with this process

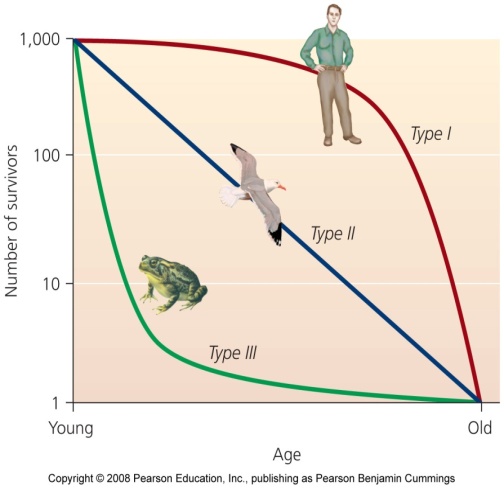
**Organismal ecology: niche**

* Niche = an organism’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in a community
  + Habitat use, food selection, role in energy and nutrient flow
  + Interactions with other individuals
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = species with narrow niches and very specific requirements
  + Extremely good at what they do, but vulnerable to change
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= species with broad niches that can use a wide array of habitats and resources
  + Able to live in many different places

**Population characteristics**

* All populations show characteristics that help scientists predict their future dynamics
* Population size =
* Population density =
  + High densities make it easier

**Population characteristics**

* Population distribution (dispersion) = spatial arrangement of organisms within an area
  + *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* – haphazardly located individuals, with no pattern
  + *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*– individuals are evenly spaced due to territoriality
  + *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* – arranged according to availability of resources
    - Most common in nature

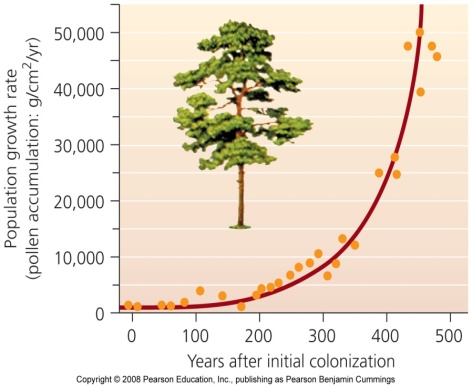
**Birth and death rates**

* Survivorship curves = the likelihood of death varies with age
* Type I:
* Type II:
* Type III:

**Four factors of population change**

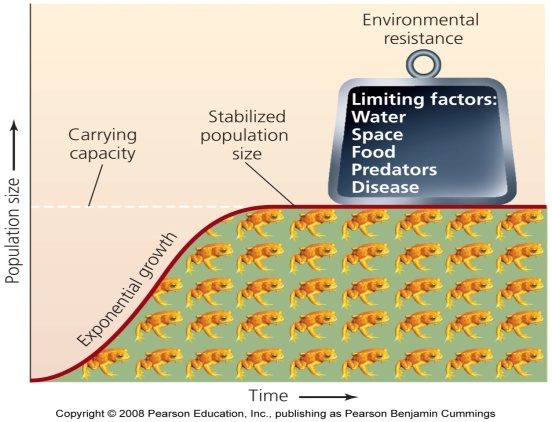
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = births within the population
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = deaths within the population
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_= arrival of individuals from outside the population
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = departure of individuals from the population

Growth rate formula =

**Exponential population growth**

* *Steady* growth rates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ population growth
  + Something increases by a fixed percent
  + Graphed as a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ curve
* Exponential growth cannot be sustained indefinitely
  + It occurs in nature with a small population and ideal conditions

**Limiting factors restrain growth**

* Limiting factors =
  + Water, space, food, predators, and disease
* Environmental resistance = All limiting factors taken together

**Carrying capacity**

* Carrying capacity =
  + An S-shaped logistic growth curve
  + Limiting factors slow and stop exponential growth
* Carrying capacity changes

*Humans have raised their carrying capacity by decreasing the carrying capacity for other species*

**Population density affects limiting factors**

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ factors = limiting factors whose influence is affected by population density
  + Increased risk of predation and competition for mates occurs with increased density
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ factors = limiting factors whose influence is not affected by population density
  + Events such as floods, fires, and landslides

**Biotic potential and reproductive strategies vary**

* Biotic potential =
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = animals with long gestation periods and few offspring
  + Have a *low* biotic potential
  + Stabilize at or near carrying capacity
  + Good competitors
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ = animals which reproduce quickly
  + Have a *high* biotic potential
  + Little parental care

